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DASHOWUZ IRRIGATION MANAGEMENT STUDY

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I. Introduction

Many of the great civilizations of the world were built on irrigated agriculture. To maintain these societies required a complex organizational structure and strong administrative capability. In particular, maintenance of irrigation, drainage and flood control systems was critical to the survival of societies. History tells us that a number of the civilizations such as the ones that existed along the Tigris-Euphrates Rivers in the Middle East and Mohanjandaro on the Indus River in the Asian Sub-Continent failed because society lost its technical and financial ability to properly maintain the irrigation and drainage infrastructure. As a result irrigated lands became highly saline and no longer could support the population.

In the United States we have a saying, ANothing is certain but death and taxes.@ Similarly, we can say with certainty that along with irrigation water comes salts. Some waters are better quality than other waters but even the best water still brings salts into the irrigated areas. As long as these salts are taken out of the area through an effective drainage system or drain down into the groundwater aquifer out of the root zone they do not reduce the potential production of irrigated crops. However, once the watertable begins to rise and the salts start to accumulate in the root zone and on the surface of the soil productivity of the irrigated area begins to decline and the long slow death of the irrigated area has begun.

In Dashowuz, overall rainfall is only around 120 mm per year and, as a result, agriculture is effectively 100% dependent upon irrigation water. Irrigation water for the region is diverted from the Amu Darya River, one of the great rivers of Central Asia. Turkmenistan has a mean annual abstraction right of 22 km^3 with about 12 km^3 diverted into the Karakum River and the remaining 10 km^3 used in the Lebap and Dashowuz areas. During the past 30 years the average salinity of the Amu Darya water downstream of the Tuyamuyun hydro-post has almost doubled as a result of diminishing flows and saline return flows. The annual river discharge has declined from 59 km^3 average during the period of 1955-1960 to 29 km^3 average for 1985-1990. Collector drainage flows from upstream areas in Uzbekistan and Turkmenistan are presently estimated at 6.5 km^3 with salinity levels that often exceed 5 gr/l. With this added salinity load, the average salinity level of the Amu Darya downstream of the Tuyamuyun Reservoir has increased from 0.5 gr/l to almost 1 gr/l. During dry years salinity levels in the river can exceed 2 gr/l. The average discharge of salts is 84 million tons per year (World Bank, 1998).

The annual irrigation diversion into Dashowuz of 7.6 km^3 discharges in excess of 7.5 million tons salts into the area. With approximately 4.4 km^3 of irrigation water supplied to the on-farm area, this means that on the average about 9 tons of salts are being applied to each ha annually. This situation is complicated by the fact that all the agricultural lands in Dashowuz are already salty with 297,000 ha classified as mid-salinity and 63,000 ha classified as very salty. The situation is even further complicated by the fact that more than half the area has a groundwater level of 2 meters or less from the surface and groundwater levels under 75% of the irrigated lands have salinity levels of

up to 5 gr/l, with levels of up to 20 gr/l observed in some places. With such high groundwater levels of very salty water, additional salts are deposited on the soil surface through capillary action as the heat of the sun pulls the groundwater to the surface. In addition, when winds blow across the Aral Sea disaster area, they pick up salts and these are also deposited on the lands in the Dashowuz area.

Salinity problems are not a new phenomena, on the contrary, they have been recognized since the development of irrigation in the area. There are presently two main collector drains that are fed by 2,628 km of off-farm and 5,672 km of on-farm drains as well as collector drains that bring water from irrigated areas in Uzbekistan. On the average annual flows from these drains via the two large collector drains is 2.21 km^3 into the Sarykamysh Lake. The salinity of the water in the collectors varies between 3 gr/l to 4 gr/l while the quality of water in the lake often exceeds 10 gr/l.

Since the Soviet time there has existed a large bureaucracy, the Water Economy, to operate and maintain this system. This was a professional organization and fairly well supported as 30% of the state budget was for water services during the Soviet time. However, during the last few years financial support for this agency has declined and now is insufficient to adequately operate and maintain all the infrastructure. For example, in 1990 the overall budget including funds for intergovernmental canals was around 75 billion manat while in 1998 it was less than 50 billion manat. Considering inflation this is more than a 50% cut in real purchasing power for operating and maintaining the aging irrigation and drainage infrastructure. Over 80% of this budget is to be provided by the Central Government and to be used on inter-etrap and inter-farm canals. In real terms this budget is inadequate and as a result the irrigation canals are not being cleanly regularly, the collector and smaller drains are silting up and the infrastructure is slowly degrading due to lack of sufficient funding for proper maintenance.

Local government does not contribute to this budget and farmers are still only required to take responsibility for on-farm irrigation and drainage infrastructure. This is a common problem facing irrigation agencies all over the world. In a sample of World Bank projects, irrigation revenues only covered 7% of costs while in most developing countries irrigation service fees cover no more than 10% to 20% of the actual costs of delivering water (Postel, 1989). These heavy central government subsidies are becoming unsustainable and countries have come to realize that if they want to keep their irrigation and drainage systems functioning the beneficiaries of the irrigation services must pay for the irrigation, and drainage, services provided. Countries such as Mexico, Turkey, China, Indonesia, and Pakistan, to name just a few, have instituted programs to transfer local operation and maintenance (O&M) responsibilities to the water users, as well as asking them to pay a portion of the costs for the irrigation services provided. Other countries in the Central Asian Republics such as Kazakhstan and Kyrgyzstan are also starting to institute programs where the local users are expected to contribute toward sustainable O&M of the on-and off-farm irrigation and drainage systems.

The purpose of this paper is to discuss the irrigation management situation in Turkmenistan and to explore possible options for ensuring that the system is operated and maintained sustainably. If the country does not address the present deficiencies in irrigation management and drainage, the soils in Dashowuz will continue to become saltier and saltier and the agricultural productivity in the

region will continue to decline. As Dashowuz is one of the major agricultural regions in the country, Turkmenistan cannot afford to allow this to happen and therefore must find a means to sustain the irrigation and drainage system

II. Dashowuz

As the Amu Darya is actually located in Uzbekistan, the diversion canals that serve Dashowuz first pass through Uzbekistan before entering into Turkmenistan. The Basin Water Association (BVO) for the Amu Darya is responsible for determining the allocations into the canals that supply Dashowuz velayat. The BVO meets once each quarter to review the situation on the river and revise their allocations based on revised flow estimates. Table 1 details the main intergovernmental irrigation canals that serve the area.

Table 1 Main Intergovernmental Irrigation Canals that Serve Dashowuz

Canal System	Design Capacity (m3/sec)	Length in Turkmenistan (km)
Gazavat	80	4
Shavat	160	48
Klich-Niaz	60	38
Han-Yap (Soviet-Yap)	180	72
Total	480	162

Source: World Bank 1998 and Dashowuz Water Economy

Dashowuz Velayat is primarily a desert except for the area located in the north-east where the irrigation schemes are located. Parts of this area have been irrigated with smaller canals off the Amu Darya since before written records. Today, the total land area that can be irrigated is approximately 27% of the total irrigated land in the country of 1.75 million ha. The Amu Darya has a catchment area of 1.16 million km^2 and the mean annual flow is estimated at 78.5 km^3 with annual variations between 46.9 km^3 and 108.4 km^3. Figure 1 illustrates the average annual flow from 1987 to 1996 at Tuyamuyon Hydro-post.

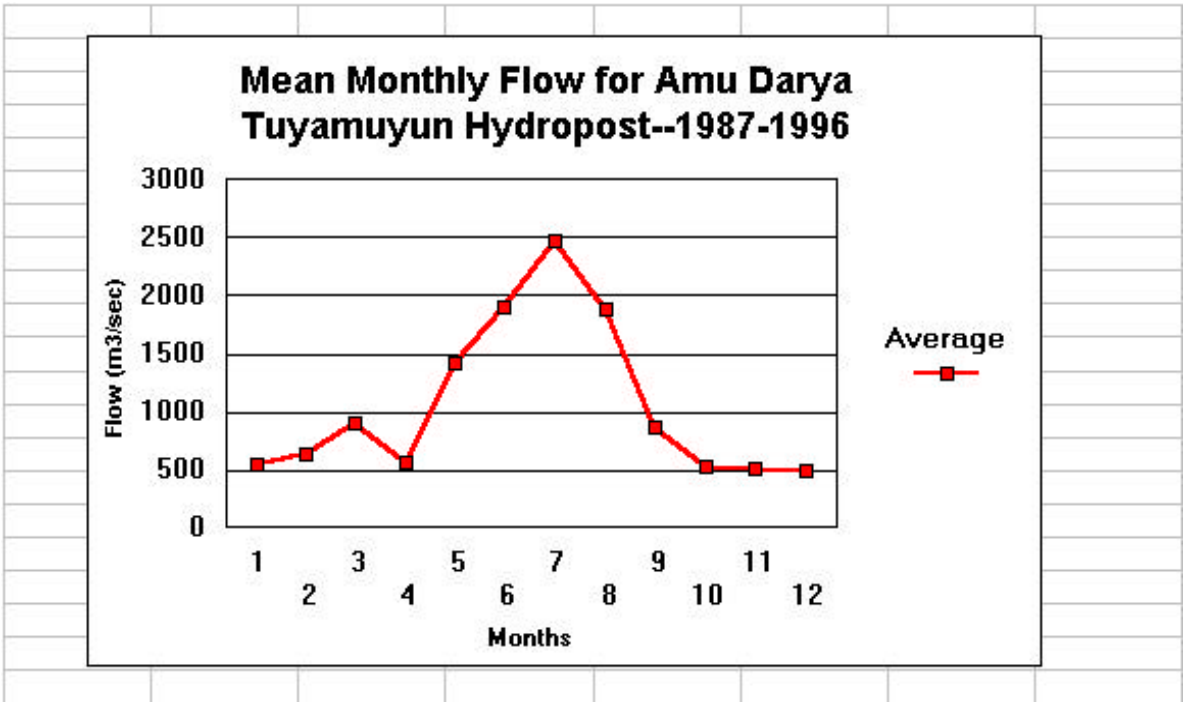

Figure 1 Average Annual Flow of the Amu Darya at Tuyamuyon Hydro-post

The total length of the irrigation distribution network is 13,600 km including 3,157 km of canals that serve the Daihan Associations and 10,433 canals that serve the fields inside the Daihan Associations. The total volume of irrigation water provided inside Dashowuz Velayat is 6.73 km^3 and the water provided to the Daihan Associations at the hydro-posts is 4.44 km^3. Table 2 contains details about the irrigated land and water supply by Etrap.

Table 2 Irrigated Land by Etrap and Total Water Supply

Etrap	Irrigated Lands (ha)	Length of Canals (km)	Off-Farm Canals (km)	On-Farm Canals (km)	Gross Water Supply (km^3)	Daihan Water Supply (km^3)	Field Water Supply (m^3/ha)
Dashowuz	61000	1299	277	1022	.775	.609	10000
Tahta	59000	3109	195	2914	.798	.606	10300
Yilanly	57000	724	313	411	.654	.484	8500
Akdepe	59000	1319	394	925	.796	.576	9600
Boldumsaz	34000	329	178	151	.355	.266	7800
Gubadag	39000	591	156	435	.495	.373	9600
Kyone-Urgench	61000	1901	303	1598	.787	.569	9300
Turkmenbashi	90000	3595	608	2987	1.291	.958	10700
Inter-Etrap Canals		733	733				
Technical Losses					.780		
Total-Velayat	460000	13600	3157	10443	6.731	4.441	9600

Source: Dashowuz Velayat Water Economy

Delivery efficiency is estimated at no more than 66%. Taking into account intra-Daihan and field application losses, the overall system efficiency is less than 50%. That the overall efficiency is rather low is clearly illustrated by the fact that of the 6.731 km^3 delivered to the system, 2.21 km^3 is taken out of the system in the major collector drains.

In spite of the drainage system and the large collectors that are taking massive amounts of saline water out of the area, it appears that the groundwater and agricultural soils are getting saltier. Table 3 clearly shows that between 1990 and 1995 there was a gradual increase in the percentage of lands with a high water table.

Table 3 Depth to Groundwater (m) 1990 and 1995

	Distribution of Irrigation Area (ha)					
Area	<1 m	1-1.5 m	1.5-2 m	2-3 m	3-5 m	>5 m
Dashowuz (1990)	605 (0.2%)	24,638 (7.6%)	156,682 (48.2%)	123,861 (38.1%)	19.630 (6.0)	-
Dashowuz (1995)	19,275 (4.8%)	78,995 (19.5%)	139,549 (34.5%)	88,859 (22.0%)	25,108 (6.2)	52,892 (13.1)

Data from Hydro-geological Melioration Expeditions

In Dashowuz Velayat the groundwater salinity levels have also increased between 1990 and 1995. The total area with groundwater levels between 1-3 gr/l and exceeding 3 gr/l increased by about 50% each. Much of this increase was the result of opening new land that was already underlain by saline groundwater.

Table 4 Groundwater Salinity Levels (gr/l) Distributed By Area (ha) 1990 and 1995

	1990				1995			
	Non-saline	Slightly-saline	Medium-saline	High-saline	Non-saline	Slightly-saline	Medium-saline	High-saline
	<2.5gr/l	2.5-5 gr/l	5-10 gr/l	>10 gr/l	<2.5 gr/l	2.5-5 gr/l	5-10 gr/l	>10 gr/l
Dash. Total		106,382 (32.7%)	167,168 (51.4%)	51,866 (15.9%)	780 (0.2%)	52,246 (12.9%)	287,067 (70.9%)	64,585 (16.0%)
Turk. Total					78,419 (4.5%)	492,025 (28.3%)	957,255 (55.1%)	209,928 (12.1%)

Data from Hydro-geological Melioration Expeditions

As can be seen in Table 4, the lands with medium- to high-salinity levels have increased significantly between 1990 and 1995. While the area with slightly saline lands decreased the area with medium saline lands almost doubled. The situation in Dashowuz is also worse than the situation in the other parts of the country. The main reasons for soil salinization are the increasing salinity levels of the Amu Darya, over-irrigation, under-leaching, lack of drainage and the high water tables (World Bank, 1998).

Increasing salinity in the irrigated soil in Dashowuz Velayat is one of the main contributing factors to the decline in agricultural productivity which in turn is reducing the viability of the

agricultural economy.

III. Agricultural Economy

In Dashowuz waters from the Amu Darya serve about 460,000 irrigated ha on 138 state and collective farms in the eight etraps of the velayat. This land is part of the old delta of the Amu Darya and the soils are primarily sand loam and clay loam. The elevation averages around 200 meters ASL and the topography is quite flat and suitable for gravity irrigation. The organic matter content is less than 1% and soil fertility is rather low due to the reduction in the use of organic and chemical fertilizers as well as the excess water applied for leaching purposes.

The major crop grown on the 460,000 ha irrigated area is cotton with 176,000 ha planted in 1999 and wheat is the next crop in importance with 70,000 ha planted during the 1998/99 season. Other crops include 5,000 ha of rice, 5,000 ha of alfalfa, 2,500 ha of orchard, 1,500 ha of maize for green fodder, 1,000 ha of vegetables and assorted other crops such as sugar beets and fodder for livestock. As much as 10-15% of the land is used for farm garden plots as the population supplements its income through assorted crops and small livestock maintained on their garden plots. In fact, this is a very important source of income and nutrition and is how they appear to support themselves while they wait to be paid for their cotton and wheat crops.

Yields are universally low in the area. Cotton yields in Dashowuz are less than 2 ton/ha which is lower than the Turkmenistan average and much lower than is needed to provide good returns to the labor force. Based on government reported figures, in 1998 average yields for the entire Dashowuz Velayat was less than 1.0 ton/ha due to serious pest problems. The 1999 target is 2.35 tons/ha but the leaseholders and local officials appear doubtful about being able to reach this target. Wheat yields are also very disappointing although during 1998 the average for Dashowuz Velayat was higher than 1997. The 1998/99 target is 1.71 tons/ha which may be achieved if the weather is favorable. In general, low yields of both crops can be attributed to:

(1) questionable seed quality and lack of new seed;
(2) inadequate fertilizer, particularly the lack of balanced fertilizers to match soil needs;
(3) pest problems and lack of access to pesticides;
(4) lack of water for early season leaching;
(5) irrigation and drainage problems leading to high water tables and soil salinity; and
(6) lack of timely machines services

Table 5 contains data on the total production and yields of cotton and wheat in Dashowuz Velayat for the years 1996 through 1998.

Table 5 Cotton and Winter Wheat Production in Dashowuz Velayat B 1996 through 1998

	1996				1997				1998			
	Cotton		Wheat		Cotton		Wheat		Cotton		Wheat	
Etraps	ha	tons	ha	tons	ha	tons	ha	tons	ha	tons	ha	tons
Dashowuz	20259	21200	9108	6300	20259	27700	9108	11700	20976	14500	8675	13900
Tahta	25941	25100	10221	6000	25515	32900	11262	13600	25515	23200	11262	16900
Yilanly	25100	12900	10003	3300	24000	20400	10717	10700	21077	16400	9648	14500
Akdepe	20100	11600	10108	4600	20222	19200	10452	10600	21141	18900	11728	15200
Boldumsaz	10953	6100	7197	2400	11006	10300	6615	5900	11215	10700	7722	10800
Gubadag	13805	9600	9252	4200	14027	19200	6249	10700	16005	16500	7633	17600
Kyone-Urgench	23347	13800	10316	2800	23766	24300	11330	8200	27249	22000	11418	16700
Turkmenbashi	39502	27200	11162	5900	39612	44700	11696	15000	43500	40200	10814	20000
Total Dashowuz Velayat	179007	127500	77367	35500	178407	198700	77429	86400	186678	162400	78900	125600

	1996 (tons/ha)		1997 (tons/ha)		1998 (tons/ha)	
Etraps	Cotton	Wheat	Cotton	Wheat	Cotton	Wheat
Dashowuz	1.05	0.69	1.37	1.28	0.69	1.60
Tahta	0.97	0.59	1.29	1.21	0.91	1.50
Yilanly	0.51	0.33	0.85	1.00	0.78	1.50
Akdepe	0.58	0.46	0.95	1.01	0.89	1.30
Boldumsaz	0.56	0.33	0.94	0.89	0.95	1.40
Gubadag	0.70	0.45	1.37	1.71	1.03	2.31

Kyone-Urgench	0.59	0.27	1.02	0.72	0.81	1.46						
Turkmenbashi	0.69	0.53	1.13	1.28	0.92	1.85						
Total Dashowuz Velayat	0.71	0.46	1.11	1.12	0.87	1.59						

Source: Dashowuz Velayat

In addition to the major crops of cotton and wheat, at one time Dashowuz produced 50% of all the rice produced in the Soviet Union and the Kremlin consumed Turkmen rice. However, with the serious water logging problems and the shortage of water supply for the region, rice production has been reduced significantly. In 1999, as the flow is relatively low on the Amu Darya, leaseholders have been told to almost eliminate land planted to rice and instead grow alfalfa or maize fodder in order to reduce water demands. However, cotton and wheat are by far the dominant crops grown in the area. They are supposed to be grown in a rotation, primarily with alfalfa. For example, a rotation of 2 years of alfalfa and 4 years of cotton is normally recommended. Yet, as a very small area is planted in alfalfa, there appears to be a large percentage of land in monoculture.

The structure of agricultural production in Turkmenistan, like in many of the Central Asian Republics, is a mix of reorganized state and collective farms. State and collective farms were converted to Peasant Associations in 1995 by Presidential Decree which was seen as a move toward privatization. However, cotton and grain farmers continue to work under state orders and must sell to state purchasing agents at state controlled prices. The agricultural land has been leased to the members of the Peasant Association at no cost for a period of 10 to 15 years with the limitation that farmers produce wheat and cotton and meet production targets as per the state directive. Farmers that perform satisfactorily and meet or exceed their production targets are entitled to ownership of the leased parcel although this still does not give them the right to sell their land (USDA, 1998).

The state establishes a quota for production of wheat and cotton each Velayat which in turn establishes a quota for each Etrap. The Hakim of the Etrap then assigns a quota for each of the Daihan Associations. The Achin of the Daihan Association assigns land to each leaseholder in order to attempt to fulfill the quota for that association. Leaseholders that are able to fulfill their quotas are assigned a lease the following year and even may be able to obtain another piece of land or a larger lease if the Achin feels they can use the land productively. On the other hand, leaseholders that do not use their land or fail to meet their quotas can lose their lease or have it reduced.

Table 6 lists the number of leases for cotton and wheat in the Velayat by Etrap as well as comparing the number of hectares planned versus the number actually planted. As can be seen, the system is effective as very little of the planned land was not planted. This reflects the concern of the leaseholders that they may lose their lease if they do not meet their quota. However, planting the crop does not ensure that the quotas will be met. In fact, neither the wheat or cotton quotas were met in 1998, although the country did produce in excess of 1 million tons of wheat. With an average of 0.85 tons/ha Dashowuz Velayat was very short of its cotton quota (2.3 tons/ha) in all Etraps. However, as the wheat quota is much less optimistic a few Etraps made the wheat quota. Since Hakims have lost their jobs by failing to achieve their assigned quotas there is pressure on the farmers to produce more, even though the system is not providing the quality seeds, fertilizers and, in particular, pest control services needed to produce the higher yields.

Difficulties with irrigation and, especially drainage, also make it difficult for the State to expect farmers in Dashowuz to be able to meet their assigned quotas.

Table 6 Number of Leaseholds and Area Planned and Planted in DashowuzB1999

County (Etrap)	No. Daihan Assoc.	Type of Crop	Total No. of Leaseholders	Planned Area (ha)	Planted Area (ha)
Dashowuz	17	wheat	1877	9709	9709
		Cotton	9240	20100	20130
Tahta	16	wheat	1424	9200	9200
		Cotton	12626	23600	23469
Yilanly	13	wheat	1437	9899	9899
		Cotton	9170	20700	20386
Akdepe	18	wheat	1285	9890	9890
		Cotton	7374	19700	19700
Boldumsaz	9	wheat	1582	7226	7226
		Cotton	3610	10300	10300
Gubadag	13	wheat	1882	8552	8552
		Cotton	8142	14100	14100
Kyone-Urgench	23	wheat	9700	10000	10000
		Cotton	8480	25400	25400
Turkmenbashi	24	wheat	1083	10561	10561
		Cotton	12127	42100	42100
Totals	**133**	**wheat**	**20270**	**75037**	**75037**
		Cotton	**70769**	**176000**	**175585**

Source: Dashowuz Velayat Water Economy

Leaseholders within the Peasant Associations are dependent upon the state for almost all production decisions, input supplies, credit and marketing. Their own inputs are labor and a limited amount of management. Inputs for crops grown under state order (wheat and cotton) for leaseholders are heavily subsidized. Chemical fertilizers, technical and machinery services, other agricultural chemicals, etc. are provided by State enterprises at State fixed prices and leaseholders have no other alternative source of supplies. For the state order crops of cotton and wheat the amount used is charged to a farmer-s mandatory Daihan Bank account at 50% of the state determined price. Natural gas, electricity and irrigation water are also provided free. Each leaseholder produces to an individual state order contract for wheat and cotton. Total production multiplied by the state established price is credited to the producer-s account. Residual income after subtracting the debits for inputs as well as subtracting 2% of the gross production for interest on the loan, 1.5% of the gross production for banking services, 3% of the gross production for irrigation services and 9% of the gross production for Daihan Association and other services, is paid to the leaseholder as profit.

All prices are established by the State and have little relationship with world prices. For example, the price to farmers for field cotton is a maximum of 1 million manat per ton, depending upon quality. This is approximately US$60/ton at the market exchange rate or US$180/ton at the official exchange rate Similarly, the price for leaseholders for wheat is 400,000 manat per ton. This is around US$24/ton at the market exchange rate, or US$75/ton at the official exchange rate. Conversion from field cotton to fiber is 33.9% for the top grade and around 28.3% for the grade 4 cotton. Farmers do not receive any payment for their seeds which is unusual as in the US and other countries farmers make 10-12% of their income from the cotton seed they sell to the gin.

Fertilizer and mechanical services are provided at State established prices. For example, nitrogen fertilizer is provided at 660,000 manat per ton with a 50% subsidy for state crop producers while Super Phosphate fertilizer is priced at 853,894 manat per ton with a 50% subsidy to state crop producers. Ammonium Sulphate is imported from Uzbekistan and is presently priced at 365,548 manat per ton with no subsidy as it is used on rice, a non-State crop.

At the recommended rates of 400 kg/ha nitrogen and 150 kg/ha of phosphorous for cotton, fertilizer costs are around 200,000 manat per ha or US$12/ha at market exchange prices or US$38/ha at the official exchange rate. This can be compared to the fertilizer expenditures of US$131/ha paid in 1997 by Mexican cotton farmers, or US$156/ha paid by Mississippi Delta cotton farmers.

Mechanical services are also subsidized, and in fact in terms of the real costs may actually have a heavier subsidy than the chemical inputs. For example, one cotton farmer had pest problems in 1998. He and other nearby leaseholders requested aerial spray and it was provided. They were only charged 40,000 manat/ha for the service. In 1998 the ceiling for mechanical services was 250,000 manat which does not even cover the real depreciation costs for the imported equipment used in preparing the land, planting the crop, tilling the soil, harvesting the crop and transporting the product to the cotton gins and wheat silos. As a result, the mechanical services enterprise finds it very difficult to keep their equipment properly maintained and provide the services promised. Table 7 illustrates this process of calculating the gross returns, expenses and net returns for a brigade of

cotton producers on a Daihan Association in Yilanly Etrap.

Table 7 Cotton Returns 1998 Daihan Bank at the Branch "Hakykat"

		Forecasts Based on Agreement			Actual Production				Expenses						
Farmers	Hectares (ha)	Yield (Tons/ha)	Total Yield (Kgs)	Value of Production (Manat)	Actual Yield (tons/ha)	Actual yield (kgs)	Production Value (Manat)	Loan Allocated (Manat)	2% of Loan (Manat)	Bank Services 1.5% (Manat)	Payment to State 8%* (Manat)	12% to the Daihan Assoc. (Manat)	Advance on Payment during the Harvest	Total Expenses (Manat)	Amount Paid Leaseholders (Production Value less Expenses)
1	2.0	3.0	6000	6000000	2.59	5189	5145300	506730	5632	69494	411624	617436	625050	2175606	2462964
2	2.0	3.2	6400	6400000	0.65	1301	1289500	769140	9919	7805	103160	154740	150300	520360	0
3	2.0	3.0	6000	6000000	0.52	1049	1002600	589806	6858	6192	80208	120312	87900	367149	45645
4	2.0	3.2	6400	6400000	0.75	1499	1488600	641362	8581	12709	119088	178632	191400	737410	109828
5	2.0	3.2	6400	6400000	0.60	1205	1184100	737496	8800	6699	94728	127635	130900	446604	0
6	2.0	2.5	5000	5000000	0.19	374	374000	34568	366	5091	29920	44880	0	312331	27101
7	3.0	2.8	8400	8400000	0.91	2731	2718600	1217912	12933	22510	217488	326232	346650	1167313	333375
8	2.0	3.2	6400	6400000	0.59	1177	1173300	795227	9545	5671	93864	48670	154650	378073	0
9	2.0	3.2	6400	6400000	0.63	1258	1240600	865230	8815	5631	99248	99796	156900	375370	0
10	1.0	3.0	3000	3000000	0.50	498	498000	361085	3938	2054	937	0	66900	136915	0
11	3.0	2.5	7500	7500000	0.00	0	0	622343	0	0	0	0	0	0	-622343
12	2.0	3.2	6400	6400000	0.54	1087	1087000	505138	6612	8728	86960	130440	163200	581862	0
13	1.0	2.8	2800	2800000	3.09	3092	3050700	320469	3915	40953	244056	366084	268200	1003913	1726318
14	2.0	3.0	6000	6000000	0.58	1165	1165000	667876	8267	7457	93200	139800	102600	497124	0
15	2.0	3.0	6000	6000000	0.54	1077	1067600	675539	8727	5881	85408	128112	99750	392061	0
16	2.0	3.2	6400	6400000	0.34	676	676000	553652	6650	1835	43036	0	57150	122348	0
Avrages	2.0	3.0	5969	5968750	0.81	1461	1447556	616473	6847	13044	112683	155173	162597	575902	255180
	Average Yield per Ha (ton/ha)		0.85												
	Average Net Income		127590												

	Per Ha (Manat)													

Source: Daihan Bank at Hakykat Daihan Association

While the target yield was 3.0 tons/ha, the average yield was 0.81 tons/ha. As a result, out of 16 leaseholders in the cotton brigade only seven of the leaseholders received any cash revenue for their production. Eight of the other leaseholders earned less than their loans and advanced payments while one leaseholder had zero production and is in debt the amount of his loan to the bank. On the 30 ha that yielded a crop, the average income to the farmers, after expenses and payments to the Bank and Daihan Association, was 165,347 manat/ha. This is less than US$10/ha at the market exchange rate or US$31/ha at the official exchange rate. Based on labor use information provided by TACIS, this works out to around 3000 manat per day of cultivation and harvest labor.

IV. Institutional Constraints

Prior to the breakup of the Soviet Union, large state and collective farm were responsible for the on-farm irrigation activities while the Water Economy only had to deliver water to the hydro-post for the farm and remove drainage water that drained off the farm. All on-farm irrigation and drainage activities, both operations and maintenance, were the responsibilities of the hydro-technician and brigades on the farm and the financing for their services was provided through the farm budget. After the state and collective farms were disbanded, the land was distributed to the peasants as leaseholders, and Daihan Associations with the leaseholders as members were established.

In addition to responsibility to ensure that leaseholders produced their state quota crops, Daihan Associations were also to have hydro-technicians and irrigation O&M staff to manage the irrigation water once it entered the irrigated land under the control of the Daihan Association. This is similar to the situation in Kyrgyzstan where they tried to assign responsibility for irrigation O&M to the Village Councils after disbanding the state and collective farms. This did not work as the Village Councils had no budget nor staff to manage irrigation O&M along with all their other responsibilities. This also seems to be the same case with the Daihan Associations as they do not have any budget or sufficient staff to properly operate and maintain the irrigation system on the farm.

In both cases irrigation O&M on-farm has suffered as there is a vacuum of responsibility. The Water Economy knows it is supposed to deliver water to the hydro-post and the leaseholders know they are responsible for irrigation and maintenance activities on their plot of land, but there is not a clearly designated organization capable of managing water from the hydro-post to the leaseholders. The water economy has tried to solve this situation by making the Daihan Association hydro-technicians their employees but they do not have the staff budget nor the mandate to make this expansion of their area of responsibility. As a result, on-farm irrigation is one of the weakest links in the chain between the river and the leaseholder fields.

The Government has tried to address part o f the problem by instituting a 3% charge on gross income of the state crops with the funds to be used by the Water Economy for irrigation maintenance activities within the Daihan Associations. However, this does not solve the on-farm O&M staff problems nor does it address the need to raise more funding for both the on-farm and off-farm parts of the irrigation system.

Kazakhstan and Kyrgyzstan are also facing this same situation as are many other former Soviet countries such as Albania, Armenia and Bulgaria as well as other countries in Latin America and Asia. With a shortage of funding to continue to subsidize irrigation O&M both on- and off-farm, countries are opting to transfer responsibility for managing water at those levels to local farmer associations. These associations come in many shapes and sizes but in most cases they are some type of an association of the water users, or a Water Users Association (WUA) for short. There are also other organizational models such as contracting with private water companies, public water utilities, irrigation districts, mutual shareholding companies, private concessionaires, and local government service units that are being used in different countries. Concessionaires, mutual shareholding

companies and village government models are all popular in some areas of China. However, in general the WUA model is the one that most countries in the former Soviet Union are selecting to replace the irrigation functions performed previously by the hydro-technicians and irrigation brigades on the former state and collective farms.

V. Potential Solutions

Irrigation Management Transfer

During the past decade, unsatisfactory management performance of government bureaucracies combined with financial pressures due to declining budgetary allocations have fueled the worldwide process of decentralization of services, including irrigation. The decline of communist regimes and widespread structural adjustment programs have reduced the role of the State and the expanded the roles of non-governmental organizations (NGOs) and local organizations in management of the provision of services.

Rapid expansion of public irrigation systems has led to an explosive increase in the need for public funding to operate and maintain the systems. Government efforts to finance and maintain irrigation infrastructure, and to collect water charges from the users, have been unsuccessful (Easter, 1993). As a result, failure to properly finance and manage irrigation systems has led to rapid deterioration, poor water distribution, reduced service areas and lower than planned agricultural production. In many cases, the lands have also become water logged and saline due to the lack of proper support of the critical drainage function. Governments all over the world are now looking at irrigation management transfer (IMT) as a means of reducing the costs of irrigation to the government. IMT is also seen as a means of giving the water users better control of the irrigation system in order to increase overall agricultural productivity (Johnson, 1995).

The term IMT is usually taken to mean the transfer of responsibility and authority for irrigation management from a government agency to non-governmental organizations such as WUAs. This may include complete transfer of all management functions as in the case of smaller irrigation systems in Nepal and Indonesia, or partial transfer of management functions where WUAs assume responsibility at sub-system levels such as the on-farm irrigation system below the hydro-post as is happening in Kyrgyzstan or on the secondary canals and below as is happening in Mexico. After transfer, O&M responsibility will be that of the WUA and they will be the group that makes management decisions, although the group that implements those decisions is usually hired by the WUA, not farmers them selves.

In order to determine the best level where to institute IMT, it is necessary to examine the structure of the overall irrigation system. Water is managed at many levels in an irrigation system. There is normally a clear definition of the water service that needs to be provided at each interface between hydraulic levels. The interface between one hydraulic level and the next one is the point where an upstream organization provides a service to the next downstream level, which in turn may provide a service to other levels below. The interface between two levels is the logical place for a boundary between two organizations.

The following are questions that FAO (1998) has developed to determine what service area should be transferred from government control to a WUA or another form of non-governmental

entity.

- At what hydraulic level is the service area so large, and the environmental, technical and political issues so complex, that only the government can manage the system at that level?
- Down to what level is the government capable of providing an acceptable service?
- Which levels are so closely interconnected that it would be detrimental to separate them into different management entities?
- Up to what level can the system be managed by a non-governmental service provider that would be accountable to both water users and government policy?

In the case of Turkmenistan, as in many of the Central Asian Republics, the interface between former state and collective farms and the irrigation delivery system was at the hydro-post. Thus the Water Economy provided water at the boundary of a farm and the farm was responsible for irrigation from that point on. These former state and collective farm service areas are normally 1,500 to 3,500 ha in size. In other countries this has proven to be a manageable size. It is large enough to have economies of scale with respect to fixed costs while small enough to be managed by the WUA management staff. WUAs smaller than this, such as are found in the Philippines and Indonesia, are too small to be able to cover the fixed costs of maintaining an association and consequently have had problems with their financial situation. The transfer program in Mexico first started with smaller associations, but soon realized that larger associations were needed in order to keep the irrigation water costs at a reasonable level. However, the very large WUAs like the one covering 50,000 ha in Northern Mexico has proven to be too large to manage efficiently. Given that the current size of the former state and collective farms in Turkmenistan is in a reasonable range, this makes sense as the point where IMT should be focused.

The decision if a country should institute a program of IMT will depend upon whether the country policy makers can answer the following questions positively:

- Is IMT considered necessary to address current irrigation financial and management gaps?
- Will IMT be feasible to implement in the country=s social and political framework?
- Is there strong enough political commitment to IMT in order to overcome the resistance from different groups?

As IMT often displaces well entrenched bureaucracies, it is potentially sensitive and there may be resistance by groups such as irrigation agencies. Therefore, it is important that the decision to adopt an IMT program be made and announced at the ministerial or presidential level. A formal decision to adopt an IMT program in Turkmenistan will require support from Hakims of the Velayats and continuing direction and pressure will probably be required to sustain the program through policy formulation and implementation. If political support at the highest level is not possible or sustainable, the country may not be ready to adopt an IMT policyBeven if it is determined that IMT is needed and technically feasible (FAO, 1998).

If it is determined that the political support for IMT exists, the next step will be to define the objective of the process. It is suggested that a realistic objective for IMT in Turkmenistan might be:

To establish a leaseholder (farmer) governed financially sustainable irrigation service provider to replace Daihan Association hydro-technician and irrigation brigades for the management and maintenance of the on-farm irrigation system.

Once the decision to institute an IMT program in Turkmenistan is made, several important issues will arise that need to be addressed. There are two types of issues, policy issues (what the future should look like) and program issues (how to reach this future). Following are some policy issues that will need to be addressed.

- **$** What functions are to be transferred?
- **$** What type organization will take over these functions?
- **$** What policy and legal changes, if any, need to be made to support transfer?
- **$** What changes need to made in the responsibilities of other government agencies in order to institute IMT?
- **$** What are the financial responsibilities of the new organization (both on-farm and off-farm)?
- **$** Will the new organization receive ownership of the irrigation infrastructure and equipment or just the right to manage the system? and
- **$** Who will be responsible for future rehabilitation and modernization of the irrigation system?

Program issues involve decisions about how to implement the IMT program once a policy decision is made to implement IMT. These include:

- **$** Do any improvements in the infrastructure need to be made prior to or during the IMT process?
- **$** Which group is responsible for helping the new organization become established?
- **$** Is there to be a program of joint management while the new organization learns what is required to operate and maintain the system?
- **$** How are any irrigation agency reforms to be organized?
- **$** What group is responsible for the monitoring and evaluation of the performance of the new organization? and
- **$** Is there to continue to be any subsidies for irrigation O&M and if so where do they go and which organizations are responsible for controlling expenditures?

These questions do not need to be answered immediately but they will eventually have to be answered if Turkmenistan decides to transfer on-farm irrigation O&M responsibility to some type of WUA.

Water User Associations (WUAs)

If Turkmenistan decides to implement an IMT program they will need to form some type of association of water users at the on-farm level. This section discusses the most common type of WUA, but it must be recognized that there are many options and that this is just one possible model.

WUAs will take O&M responsibility for the on-farm irrigation system. They will take water from the Water Economy at the hydro-post and then distribute the water to the leaseholders. The proposed structure of the WUA is a Management Board of nine members elected from the leaseholders to serve three year terms of office. In order to have continuity in the Board, elections should be rotated such that every year three new members would be selected. The Board in turn would elect one member as the Chairperson to serve as spokesman for the Board. The Board would then recruit a Manager (senior hydro-technician) and an Accountant and they would in turn recruit the needed office and field staff depending upon the size of the on-farm irrigation service area.

In order to have a sustainable leaseholder-controlled organization, WUAs have two functions that must be accomplished; governance and water supply. In contrast to the view of many that WUAs are simply a mini-irrigation agency, the critical staff are not the water supply staff. Instead, for sustainable WUAs the most important part of the organization of a WUA is the Management Board as this represents the owners of the WUA, all the leaseholders (farmers) in the on-farm service area. Selection of members of the Board should be open and transparent and need to be structured in such a manner that different factions within the irrigation system are represented.

In WUAs in countries all over the world, once the Board is elected they in turn select a chairman. The chairman is simply there to serve as a spokesman for the Board. In contrast to the situation found in some countries, including the present situation in Kazakhstan and Kyrgyzstan, the important point to recognize is that the real power within the WUA should be the Board as that represents all the leaseholders (farmers), not the chairman or a few powerful farmers. The leaseholders will have to pay for the services of the association and therefore should have the say in how these services are managed.

The Board=s role is governance. They establish the rules, regulations and policies of the WUA and are responsible to ensure that these rules and regulations are properly followed. They are also responsible for sanctioning any members or hired staff that fail to abide by WUA rules. A Manager recruited by the Board has day-to-day responsibility for ensuring irrigation O&M is done properly. The Board, along with the Accountant and often an Audit Committee, is responsible to ensure that the financial matters of the WUA are maintained openly, with the highest professional standards.

While the Board is responsible for governance of the WUA, hired staff are recruited to help the association carry out its main tasks of supplying water and drainage services and maintaining the system infrastructure. These water supply functions are normally carried out by hired staff, although in some areas in China services such as irrigation O&M are contracted with private firms. Normally, in WUAs the Board has the power to hire, and fire, the Manager and Accountant and is responsible for evaluating their performance. In turn, the Manager and

Accountant recruit office staff such as a secretary and a bookkeeper as well as recruiting staff to take charge of irrigation operation and maintenance. The senior staff recruit and supervise more junior staff such as ditch riders and maintenance technicians to carry out the work.

It is important in the formation of WUAs not to confuse the governance role of the Board with the water supply role of the hired staff. It Turkmenistan it will be necessary to strengthen the participatory basis of WUAs and to ensure that WUAs are not just Hydro-services with a different name, or controlled by the staff such as the Achins of the former large state farms. Instead they must be established as organizations that are owned and controlled by the majority of the water users in the on-farm service area. Again and again, from Colombia to India, from Nigeria to Indonesia it has been demonstrated that WUAs that do not represent the users do not survive in the long-run.

Management Board--The critical element in the structure of the WUAs is the Board. This group of elected leaseholder (farmer) representatives provides governance to the association. Normally, it is best to have members of the Board elected from different sections of the irrigation system as that allows the users to know who represents them on the Board. Terms and conditions for election of the Board are defined in the By-laws of the Charter of the WUA. These should be very clear so that responsibilities and the system for selecting the Board are easily understood by all the members. The job of the Board includes:

- **$** Establish policies for the WUA
- **$** Establish rules and procedures for the WUA
- **$** Establish transparent systems for instituting sanctions of the members if necessary
- **$** Recruit and hire the manager and accountant
- **$** Establish the salary levels for the manager, accountant and other hired staff
- **$** Evaluate performance of the manager and accountant
- **$** Interact with leaseholders from their area and ensure that their interests are represented on the Board
- **$** Resolve disputes between the members that the manager cannot solve
- **$** Establish the annual irrigation service fee and inform the members of the WUA the reasoning to justify the amount
- **$** Establish procedures for auditing the accounts
- **$** Fire the manager or accountant for non-performance if necessary

Normally, the Board including the Chair is not paid any salary or honorarium but sometimes their travel costs are paid in large WUAs where the members have to travel a long distance or stay overnight to attend Board meetings. With advice from the members, the Board is responsible for hiring the staff to carry out O&M on the on-farm system. This usually includes a manager, an accountant, hydro-technicians and ditch riders, maintenance staff, a bookkeeper and a secretary. When required temporary or seasonal staff is also recruited by the WUA. As the most critical employees of the WUA are the Accountant and Manager, a sample of the tasks they must carry out are detailed below.

Accountant--The Accountant has to ensure that the WUA remains financially solvent. He

is recruited and hired by the Board and often is called to report to the Board at their meetings. His tasks include:

- $ Work with the Board and the Manager to establish the irrigation service fee needed to maintain the WUA
- $ Work with the bookkeeper and other staff to develop a program to collect the irrigation service fees and keep accounts of payment by the farmers
- $ Establish an annual budget and monitor budgetary expenditures during the year
- $ Prepare an annual report on the financial status of the WUA and provide this information to the Board and the users
- $ Responsible to ensure that any irrigation service charges are paid to the Government
- $ Responsible for ensuring that social security and any tax payments are made on time
- $ Supervise the bookkeeper and office staff
- $ Maintain the WUA bank accounts
- $ Pay for any purchased equipment or other equipment and supplies purchased by the WUA

Manager--The manager is recruited and hired by the Board and serves at the request of the Board. If the Board is not pleased with his performance they have the right to fire him and request him to leave the WUA. The tasks to be carried out by the manager include:

- $ Implement the rules and regulations established by the Board
- $ Institute a management system to carry out O&M on the system
- $ Recruit and hire hydro-technicians, ditch riders and maintenance technicians as needed-these may be permanent staff or seasonal
- $ Work with the accountant to develop a system to collect irrigation service fees
- $ Supervise the hired staff to make certain O&M functions are being carried out properly
- $ Develop a system to monitor and evaluate the performance of the hired staff
- $ Recommend staff for salary increases and bonuses
- $ Interact with the farmers in order to ensure that O&M tasks are being completed properly
- $ Identify staff for training and help arrange training courses
- $ Help farmers resolve conflicts
- $ Work with the Board, staff and the farmers to develop an allocation system to ensure equity in terms of distribution
- $ Monitor maintenance and make certain the irrigation infrastructure is being maintained properly
- $ Oversee the use of any transportation or other WUA equipment and supplies
- $ Fire staff that are not performing adequately
- $ Maintain proper accounts of any money under his responsibility
- $ Prepare annual budgets for salaries, equipment and supplies

The key to developing strong hired staff for WUAs is training. If the objective is to have strong, viable WUAs training is the first priority. Training courses have to range from courses to help the Board learn how to serve the WUA to courses for managers, accountants, ditch riders, maintenance technicians, bookkeepers, and of course, workshops for the farmers themselves so they can understand their responsibilities as members of WUAs (see Annex 1 for a sample set of training courses for strengthening WUAs).

Funding WUAs

WUAs are to take over responsibility for on-farm irrigation O&M and ensure that the systems operated and are maintained in a sustainable manner. This means that they must have sufficient funding to do their tasks. In most countries, the funds used by WUAs are generated internally through irrigation service fees. Presently, in Turkmenistan, the farmers that grow state crops pay 12% of the gross revenue to the Daihan Association. Of that 12%, 3% is used for irrigation O&M by the Water Economy for irrigation activities within the Daihan Association boundaries. A portion of the other 3% is to be used to pay for staff for the Daihan Association. Presently, the 3% is used by the Water Economy to provide maintenance service for the on-farm systems with almost no funds being spent for O&M activities by the Daihan Associations.

When the WUA is formed, they will have to establish an irrigation service fee. One example how that is done is in Mexico where the irrigation service fee is established in negotiation with the irrigation agency, with the stipulation that the fee must be enough to cover the costs of operating and maintaining the system in a sustainable manner. Of the amount collected, around 75% is used by the WUA for on-farm irrigation O&M and 25% is used by the irrigation agency to cover off-farm O&M costs incurred in providing irrigation to the on-farm system. In the case of Turkmenistan, establishing realistic irrigation service fees is complicated by the fact that returns to leaseholders are low. Table 8 compares the situation in Turkey and Mexico with Turkmenistan.

Table 8 Water Fees as Percentage of Gross Returns in Mexico, Turkey and Turkmenistan

Costs/Returns	Turkey-Cotton		Mexico-Cotton		Turkmenistan-Cotton	
(US$/ha)	(US$/ha)	Fee Share (%)	(US$/ha)	Fee Share (%)	(US$/ha)	Fee Share (%)
Irrigation Service Fee	46.87		65.00		2.40 (7.60)	
Gross Returns	2231.25	2.1%	2220.40	2.9%	78.98 (253.33)	3%
Variable Costs	1395.31	3.4%	1287.10	5.1%	39.09 (125.38)	6.1% (6.1%)
Gross Margin	835.94	5.6%	933.30	6.9%	39.89	6.0%

					(127.96)	(6.0%)

Sources: Data from Manisa, Izmir, Turkey (1997), Data from Lagunera, Torreon, Mexico(1997),
Data from 1998, national average cotton seed yields (1.39 tons/ha), Department of Staistics and Forecasting, Government of Turkmenistan.

As can be seen, in Mexico and Turkey, with a water fee less than 3% of the gross returns there is plenty of money generated to pay for a more than adequate irrigation service fee, covering both on-farm irrigation O&M costs as well as the costs of the irrigation agency to deliver water to the on-farm irrigation system gate. On the other hand, the low crop prices in Turkmenistan hurt not only the farmers but also the WUA and the Water Economy as they severely limit the amount of funds that are available as an irrigation service fee.

The Kyrgyz Republic has instituted a system of charging 3.0 tien/m^3 for all irrigation services for providing water that passes the hydro-post into the on-farm system. If we assume the average inflow is around 8,000 m^3/ha this is about $6/ha. These funds are paid to the Rayon level irrigation department for off-farm O&M services. In addition, the WUAs are charging themselves from 1.0-2.0 tien/m^3 to cover the costs of maintaining their own WUA organization and water delivery staff. These amounts are probably similar to those that are required in Turkmenistan to have a viable WUA at the on-farm level and to also sustain the off-farm system. Productivity in Kyrgyzstan is probably somewhat lower than Turkmenistan, but the output prices are better and consequently farmers can afford to pay reasonable irrigation service fees.

However, the removal of subsidies and the shifting of on-farm and part of the off-farm O&M expenses to the users will not be accepted by WUAs if the irrigation agency continues to retain control. As stated by Gerards (1994):

> *The introduction of an irrigation service fee should not be simply a cover for shifting the costs of irrigation O&M to users while the government agency retains the sole right to make decisions. Without giving users and the WUA decision-making powers, an irrigation service fee program is seen by the users as just another revenue program, having the undertone of one more taxation program*

Establishing WUAs

Supporting and fostering WUAs is the other critical aspect in terms of developing sustainable on-farm level WUAs. In countries where strong NGOs exist in the rural areas, some transfer programs have used NGOs to provide this fostering function. However, in the Central Asian Republics strong NGOs are not yet in place to play this kind of role. Consequently, it is important that Etrap level Water Economy staff establish WUA Support Units at each Etrap. This will involve strengthening the Etrap Water Economy and building a specialized unit within the department but it will have some positive aspects in that it will help the Water Economy strengthen its relationship with the WUAs, its main clients. This unit will help with conflict dispute resolution for issues that cannot be resolved by the managers and the Board.

To develop strong viable WUAs, WUA Support Units (WSU-Etrap) in the Water Economy will have to develop a close relationship with the WUAs. As over the next few years

WUAs will become the main clients of the Water Economy as well as providing a significant proportion of their budget to cover O&M expenses. Therefore, like any good business, it is in the best interest of the Water Economy to develop a close working relationship with the respective WUAs within its Etrap service area. As there will only be a maximum 24 WUAs per Etrap it is not that difficult task for the Etrap Water Economy staff to get to know each and every WUA in the Etrap. This is a necessity if the Water Economy wants WUAs to support their activities.

Initially, the WSU-Etrap will make contact with a Daihan Association that is presently responsible for on-farm irrigation O&M. Using the promotion material available, the WSU-Etrap will start to discuss the idea of creating a WUA. Some Daihan Associations will be very receptive, while others will be understandably cautious. It is the job of the WSU-Etrap to continue to visit these groups and persuade them that a WUA is necessary if they are going to have reliable irrigation O&M at the on-farm level.

As groups become receptive to the idea of forming a WUA the WSU-Etraps can organize workshops that start the process of explaining how WUAs are to be formed. The difficult task is generally not that of persuading groups to form a WUA but that of persuading groups it is necessary for them to pay the real costs of providing irrigation O&M services. This is particularly difficult when irrigation has been provided free or with a heavy subsidy, but the WSU-Etrap team has to be honest with the users and let them know that their water costs are going to increase significantly. Examples in other countries when subsidies were removed include: Mexico, where water went from US$7.50/ha to US$25-40/ha, Pakistan, where water prices will increase from US$3/ha to US$25-30/ha, China, where water prices have gone from effectively free to US$40/ha, Colombia, where water fees went from $10/ha to $53/ha, etc. These examples demonstrate that farmers are willing to pay more for irrigation O&M services but that they must be sold on the idea that O&M services provided by their own WUA may be more expensive but they are better and more sustainable.

As soon as the farmers express a positive interest in establishing a WUA, the WSU-Etrap can help them become organized and established.. Since the WSU-Etrap staff will be working with a number of WUAs helping them become organized the staff will become very efficient in the process. Water Economy Velayat staff can backstop the Etrap staff if there are any difficulties.

Once WUAs are formed, the real work begins. The WSU-Etrap staff must start training the Board and recruited staff how to operate the irrigation system in a manner that is there to serve the farmers= irrigation requirements. They will also need to start training the water supply staff on techniques for proper maintenance and system operation. In addition the accountant and bookkeeper need to start learning how to keep an open set of books and develop procedures for establishing irrigation service fees and fee collection. As indicated in Annex 1 there are a number of training courses that need to be provided but as each course serves to make the WUA a stronger organization, this is a critical aspect of WUA establishment and cannot be ignored or slighted.

The WSU-Etrap will need to establish a monitoring process and help establish an inventory

of infrastructure and equipment for each WUA. It will be the WSU-Etrap's responsibility to continue to track and monitor each WUA that has been formed in their Etrap irrigation service area. With the formation of a large number of WUAs relatively quickly, it is inevitable that some of the WUAs will have problems with staff, financing or governance. It is the responsibility of the WSU-Etrap staff to know these groups well and to be aware when a WUA is having difficulties. Since maintaining strong WUAs is critical for the financial strength of the Water Economy itself, it is certainly in their own best interest to work with the WUAs and keep them healthy. This may involve some additional training or workshops or it may be necessary for the WSU-Etrap or Etrap Hakim to help with conflict resolution if there are disagreements among the users or factions of the users. Whatever needs to be done it is the responsibility of the WSU-Etrap to ensure that the WUAs stay healthy and operate smoothly. As can be seen, this means that the Water Economy and WSU-Etrap have to maintain a continuing relationship with each WUA. To repeat, this is a continuing close relationship that establishes trust as well as monitors the situation within each WUA.

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Annex 1

Two major programs of irrigation management transfer are the programs underway in Mexico and Pakistan. The following sections briefly describe those programs:

Mexico

In 1982 the Mexico Peso collapsed and the country went into a financial crisis. Due to the lack of funding the government could not continue to subsidize irrigation and consequently the irrigation systems were not properly operated and needed maintenance was deferred. In 1988 when President Salinas was elected he promised the farmers that he would institute a program to solve the problems in irrigated agriculture. In 1989, the Ministry of Agriculture and Water Resources was restructured and the National Water Commission was created with a mandate to give more control over irrigation to the farmers as well as develop a program where more of the costs of irrigation were borne by the the water users. As a result, Mexico started their transfer program in 1989 and since then has transferred in excess of 3.0 million ha in 84 large public irrigation systems to WUAs.

Over the past 10 years the country has created more than 400 financially and technically viable WUAs that have taken responsibility for irrigation O&M at the secondary canal level and down. During the first stage the National Water Commission (CNA) retains management responsibility for the water source (primarily reservoirs and the main canal and drain systems) and the main canals and drains. CNA in effect becomes a bulk water seller to the WUAs at the secondary canal gates. These WUAs then assume responsibility for all irrigation O&M in their area. WUAs range from 2,000 ha to 25,000 ha in size with the average size of the WUAs in the country around 5,000 ha.

WUAs recruit their own staff and develop a water allocation program to meet the irrigation requirements of their farmers. They also establish a maintenance program and carry out the required maintenance on the public irrigation infrastructure that has been placed under their control. At the beginning of the year the WUAs establish a budget and then charge their members for water in order to be able to maintain the organization. In most cases, prior to receiving water the users must pay for the water turn in advance. The funds from that payment are split between the WUA and CNA in proportion to the costs for providing O&M services.

After the WUAs demonstrate their ability to manage the secondary and tertiary sections of the canals and drains, they then form a federation of WUAs in a Limited Responsibility Society (SLR). SLRs assume management responsibility of the main system canals and drains as well as allocation of the water supplies to the WUAs. CNA will then only have responsibility for the water sources, which are often, reservoirs providing water to many users. To date, Mexico has created 12 SLRs with the largest system serving in excess of 300,000 ha.

The success of the program in Mexico can be attributed to the fact that the WUAs have been formed first and have demonstrated that they can operate and maintain the irrigation systems as well as collecting water fees to cover all the management costs. Under the first stage approximately 25% of the fees collected are paid to CNA to cover their costs of management at the main canal and reservoir level while 75% of the fees are used by the farmers to pay for O&M activities of the WUA staff. Under the second stage when the SLR is created, approximately 15% of the fees go to the SLR and the CNA only receives about 10% of the fees to operate the reservoirs and other water sources. The irrigation infrastructure continues to belong to the Government with the users operating it under a 20-50 year concession given by the Government.

Pakistan

With the largest contiguous irrigation system in the world, covering about 16 million irrigated hectares, Pakistan is rather unique. They have had a series of World Bank and ADB projects the last 15 years that have helped farmers improve their watercourse level on-farm systems (80-300 ha areas). However, Pakistan has now decided they need to move responsibility for irrigation management out of the public sector and create a series of farmer owned and semi-autonomous authorities to manage irrigation. After transfer is completed Pakistan=s irrigation system from the reservoirs to the farmers field gates will be managed by four separate organizations.

This will be done by first forming WUAs and federations of WUAs at the minor canal and distributary canal level (around 5,000 to 7,000 ha). These are to be responsible for irrigation O&M activities a along the distributary with all costs to be paid by the WUAs through their water fees. At the tertiary and secondary canals level, a new entity will be formed, an Area Water Board, that is organized like a public utility with responsibility for O&M. This organization will represent all the stakeholders and will be responsible selling water to the federated WUAs.

Water will be supplied to the Area Water Board from the Provincial Irrigation and Drainage Authorities (PIDAs). These quasi-government authorities will assume responsibility for management of the main canal system from the former Provincial Irrigation Departments and be responsible for bulk water supply to the Area Water Boards. The final link in this system is the Water and Power Development Authority (WAPDA) that is responsible for managing the reservoirs and river diversions. WAPDA in turn sells water to the PIDAs.

All of the costs of the federated WUAs, Area Water Boards and PIDAs are to be recovered via irrigation water fees. In addition, the irrigation portion of WAPDA=s overall costs will be paid for through water fees. This is a complex system and will take a long time to complete the total transition, but the transition to federated WUAs, Area Water Boards and PIDAs is now underway.

Annex 2

Training for Water User Associations

To establish participatory WUAs in Turkmenistan it is critical that leaseholders (farmers) are informed about the positive attributes of a WUA and the importance of WUAs in operating and maintaining the on-farm irrigation systems. Water users need to be educated about the role WUAs can play and how they can address the many problems they are facing as a result of the present water management vacuum below the hydro-post. The promotion program will begin to be seen as being effective when farmers express an interest in forming WUAs without outside prompting.

In addition to the preparation of promotional materials, in order to develop strong WUAs, it is important that a series of training courses be developed and instituted. These course need to cover a large number of topics to ensure that WUA Board members, water users and staff of the WUAs have the necessary skills to operate and maintain the systems as well as the management tools to establish budgets and ensure proper accounting of the WUAs' funds. Sound, simple and transparent management systems need to be put in place so that the individual members have confidence in the technical and honest management of the on-farm irrigation system. Subjects that need to be addressed in the training courses include:

Administration;
Personnel management, social security, taxes, insurance, etc;
Expenditure and income planning and budgeting;
Bookkeeping and audit procedures;
Irrigation and drainage system management and maintenance;
Tendering and preparation of bid documents;
Monitoring and evaluation.

It should be noted that many of the courses address management issues rather than technical engineering. In fact it can be argued that these areas are the most critical ones in terms of forming a sustainable WUA, although hired WUA staff also need technical skills to operate and maintain the irrigation system and the associated irrigation equipment.

Following are some samples of training courses for WUAs that have been implemented in settings similar to those found in the on-farm irrigation systems in Turkmenistan.

Administration

Objective:
The objective of this session is to train the participants in the adoption and use of sound, simple and transparent administrative procedures.

Subject matters:
administration of water demand and water delivery
administration of monitoring and evaluation of water deliveries
administration of monitoring and evaluation of repairs and maintenance needs and performance standards
the organization of general and extraordinary assemblies, and the distribution of the minutes of meetings to the users.
administration of the WUA office
Standard documents and procedures will be created with the participation for all standard WUA activities.

Personnel management, social security, taxes, insurance

Objective:The objective of this session is to train the participants in proper personnel management techniques.

Subjects:
processing of salary calculations and payments, according to the current legislation.
taxes, social security and pension
annual evaluations and performance indicators

Where possible, standard tables and documents will be created with the participants, as well as standard labor contracts and job descriptions.

Tendering and preparation of bid documents

Objective:
The objective of this session is to train the participants in the use of proper and transparent procedures for tenders and contracting out of certain activities (e.g., emergency maintenance).

Subjects:
preparation of standard procedures for tenders
preparation of standard documents
monitoring and evaluation systems for maintenance, and for measuring the progress of contractors performance testing procedures and quality control.

Expenditure and income planning and budgeting

Objective:
The objective of this session is to train the participants in sound and simple methods and procedures for the planning of expenditures and income, and budgeting.

Subjects:
income and expenditure
planning of activities and cost evaluation
credit/debit, active/passive and balance sheets

Standard procedures and documents will be established with the participants. As an exercise, the WUA=s budget for the 1999-cropping season will be prepared, and a planning of income and expenses will be prepared.

Main irrigation and drainage system operation and maintenance

Objective:

The objective of this session is to improve the understanding of the participants of the operation and maintenance of the irrigation and drainage infrastructure.

Subjects:
water delivery planning and water distribution schedules
P efficiencies and losses
P water measurement and canal capacities
P canal, hydraulic structure and Vertical Drainage Well operation and maintenance and repairs
P calculation of typical water charge requirements, depending on crop, area, soil, climate and growth stage.

Practical examples of water demands from the past growing season will be used in order to calculate a water allocation schedule.

Monitoring, evaluation and performance testing

Objective:
The objective of this session is to train the participants in the establishment and us of M&E, performance testing and quality control procedures.

Subjects:
establishment of an annual program of maintenance needs monitoring and evaluation
water delivery needs and evaluation
procedures for emergency repairs
procedures for the prioritization of maintenance
procedures for implementation of identified activities

Standard documents for reporting on maintenance and repair needs will be drafted with the participants, as well as procedures for follow-up and for prioritization of maintenance works.

Bookkeeping and audit procedures

Objective:
The objective of this session is to train the participants in the adoption of sound, simple and transparent book keeping methods and procedures that correspond to standard audits.

Subjects:
bills, invoices and receipts
order forms, provisional and final acceptance forms
procedures for approval of payments, depending on the amount
procedures for payment, depending on the amount
stock management

A standard set of bookkeeping documents will be prepared with the participants to illustrate the process.